

Acceptance and Performance by Clinicians Using an Ambulatory Electronic Medical Record in an HMO

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The Northwest Region of Kaiser Permanente implemented a comprehensive clinical information system in two sites between February and December 1994. By year end 46 primary care clinicians and 95 supporting personnel used the system on a daily basis to provide patient care. Clinicians use the product to select coded diagnoses, and directly order laboratory, imaging, and other tests, internal referrals, and prescriptions. They enter progress notes into the system, and use it to generate patient focused visit summaries. Clinicians took approximately 2 minutes longer, on average, to complete patient visits post implementation. Most of this time was spent performing "orders and diagnosis" work, which included new required elements in the post-implementation period. Clinicians worked approximately 30 days before reaching their baseline visit rate and "lost" approximately 48 hours of productivity during the learning, including classroom training. User acceptance improved from 2 to 4 months of use.

INTRODUCTION

The Kaiser Permanente Northwest Region (KPNWR) is the third largest of twelve regions of the Kaiser Permanente health care program. KPNWR serves over 380,000 Health Plan Members in the Portland and Salem, Oregon and Longview and Vancouver, Washington areas. Service is provided by over 800 physician and allied health clinicians and over 7,000 employees in 17 practice locations, including 2 medical centers. KPNWR has actively developed or acquired electronic clinical information systems since the mid 1970s. Prior to 1991 these represented mostly departmental systems such as those found in the clinic laboratory and pharmacy. Development of the Results Reporting System (RRS), the first phase of a comprehensive clinical information system (CIS) began in 1991.^{1,2} This system was deployed, evaluated and enhanced over the next several years and is still actively used and improved today. The practice facilities are linked via an Ethernet-based wide area bridged network. The RRS is available to all clinicians and most ancillary personnel from over 1500 terminals. Beginning in the second half of 1992, attention was turned to the next phases of our CIS. In the last quarter of

1993, the decision was made to license EpicCare, a comprehensive ambulatory electronic medical record product from Epic Systems Corporation, of Madison, Wisconsin. This product appeared to have all the functionality KPNWR anticipated needing immediately, as well as the ability to meet many of our future requirements. Direct clinician interaction with the system, including diagnostic coding, order entry, and charting functions, are supported by EpicCare and are important features of our implementation. A pilot installation of EpicCare went live at one primary care outpatient clinic in June 1994, and in a second one in September 1994. By year end 1994, 46 clinicians and 96 ancillary staff were using EpicCare on a daily basis to perform and document most of their outpatient clinical work. This paper will present results of this effort.

METHODS

The Sunset medical office, site of the initial EpicCare implementation, is a 17 clinician primary care office located in suburban west Portland. The Rockwood clinic, site of the second implementation, is a 29 clinician primary care clinic located in suburban east Portland. Clinicians in this study included 9 family physicians, 12 internists, 9 pediatricians and 16 physician assistants or nurse practitioners in primary care.

EpicCare consists of a client-server application based on an Epic Systems M database, Chronicles. The M side can run on several platforms with this implementation in a VAX environment. Production runs on a VAX 7620. DEC Alpha servers are sited at each clinic. The client side runs under the Windows operating system. Users access the system via Digital System 486, 66 MHz workstations installed in clinician offices, nursing stations, and ancillary departments. Except for a small number on a pilot basis, workstations were not installed in exam rooms. During the study period EpicCare version 1.3a was installed.

User training began in June 1994. Training was done by KPNWR training staff, with early assistance from Epic Systems. It consisted of 16 hours of class room instruction for clinicians, nurses, and pharmacists and less time for clinic assistants and most ancillary personnel. Learner groups were mixed by job description and

groups were mixed by job description and computer experience. Considerable expertise and training materials and curriculum content were developed internally. Learners generally trained one week and "went live" the following week. Approximately 10 learners, including both clinicians and support and ancillary staff, were trained in each class at Sunset. Rockwood had two classes every other week, with each class consisting of 12 learners. Clinicians were given an abbreviated schedule during the first few weeks of system use.

The project was evaluated using pre-implementation, 2 and 4-6 month post - "go live" user surveys, management engineering studies, and monitoring of clinician productivity.

Surveys focused on user attitudes and acceptance and were developed for this purpose. The pre-implementation survey consisted of 21 questions and focused on preexisting computer experience and attitudes, and preferred learning methods. The 8 week Post-"go live" survey contained 33 questions and focused on perceived efficiencies and performance with EpicCare in comparison to the previous paper system. Comments directed toward system improvements were strongly encouraged. The 4-6 month Post-"go live" survey was similar to the 8 week survey, and contained 28 questions, many of them repeated from before. Surveys were distributed to clinicians to coincide with their appropriate time from "go-live".

Management engineers conducted observations to document the actual time that different clinical "tasks" took before and after EpicCare implementation. Approximately 540 patient visits were observed at the two clinics, including pre and post implementation samples. Clinician time was assigned to one of four categories: "chart review", "exam and treat", "orders and diagnosis", and "charting". Activity in the exam room was blind to the observer and was assigned to the "exam and treat" category although many clinicians perform elements of chart review, ordering and/or charting there. The "orders and diagnosis" category included lab, imaging, medication and internal referral orders, selecting coded diagnoses, associating orders with diagnoses, writing and/or selecting standard patient instructions, maintaining problem lists, assigning EM codes, and finishing the clinical encounter via a "hand-off" to the clinic assistant. Some of the "orders" tasks (notably coding diagnoses, associating orders, and assigning EM codes) were essentially new for our clinicians in the post implementation period.

The "productivity cost" of learning the new process including EpicCare was determined. This

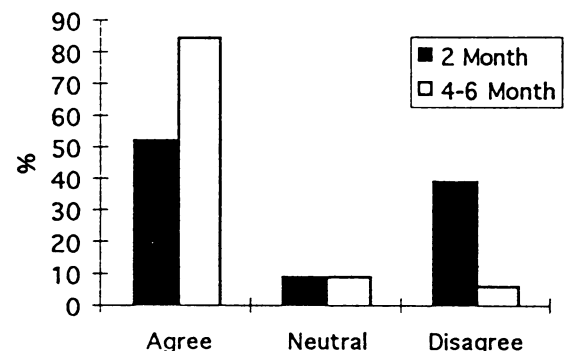
calculation was based on a visits per hour per clinician comparison of pre and post implementation time periods.

RESULTS

In pre-implementation surveys, 18% of clinicians reported their familiarity and comfort with computers as "expert or advanced", 43% as "moderate", and 39% as "novice or none". Seventy-nine percent agreed with the statement, "at work I like new challenges", while 7% disagreed. Only 15% agreed with the statement "I have reservations about computers", while 66% disagreed. Thirty-three percent agreed that "I am concerned about the CIS implementation", whereas 48% disagreed with that statement.

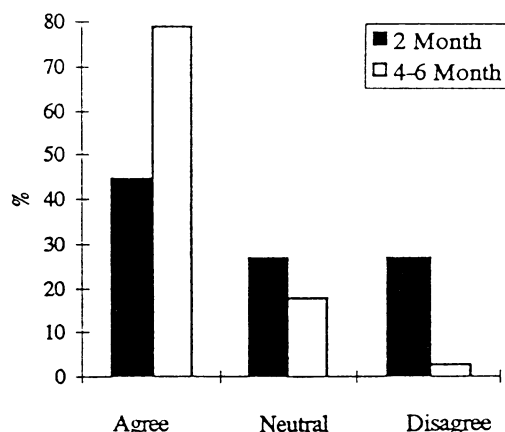
Clinician attitudes were evaluated at 2 and 4-6 months after "going live" on the system. Fifty-two percent of clinicians agreed with the statement "EpicCare is worth the time and effort required to use it" at 2 months. (Figure 1) Nine percent were neutral and 39% disagreed at that time (n=33). For clinicians reaching the 4-6 month post- "go-live" milestone, 85% now agreed, 9% were neutral and only 6% disagreed (n=34).

Figure 1. "EpicCare is worth the time and effort to use it."



In response to the statement "EpicCare is easy to use" 45% of 33 clinicians agreed at 2 months, 27% were neutral and 27% disagreed (Figure 2). When clinicians were queried at 4-6 months, 79% agreed, 18% were neutral, and 3% disagreed (n=33).

Figure 2. "EpicCare is easy to use."



A particularly noteworthy response was given to a new question at the 4 -6 month evaluation: "If given a choice, I would return to the old system". Eighty-five percent of clinicians disagreed, 6% were neutral, and only 9% agreed (n=34).

Clinician attitudes may be better understood in light of information gained in management engineering studies performed at approximately 2 months pre- and post go-live. These studies revealed that clinicians were spending about 2 minutes longer (2:10) with each patient using EpicCare compared to baseline. Nearly all of this net increase (1:56) was attributable to the "orders" task, with "charting" making the second largest contribution.

Clinicians worked 30 days, on average, before reaching the baseline visit rate for their clinic (35 days at SST, 25 days at RKW). The hours "lost" due to decreased productivity during learning the new system varied in the two clinics. Sunset had 38.5 average hours per clinician "lost", while Rockwood had 24.9 average hours "lost", not including the 16 hours of classroom training that they all underwent. Many differences existed at the two facilities including an accelerated modified learning schedule, a more experienced training team, system improvements, and more computer experienced clinician subjects in the sample at the second facility, Rockwood.

DISCUSSION

In the progression from the "read only" Results Reporting System, to the necessarily interactive comprehensive outpatient electronic medical records system, the implementation team

understood clinician acceptance would represent an important challenge. Previous attempts at requiring physicians to enter orders, choose diagnoses and enter progress notes have met with varying degrees of difficulty.^{3,4} Most successful implementations of electronic records in the past have allowed clinicians to chart and /or order on paper or via dictation with later data entry into the computer by clerical personnel.⁵⁻⁷ Sittig and Stead argue that "the rationale for physician order entry includes process improvement, support of cost conscious decision making, clinical decision support, and optimization of physician time".³ They explain that "the goals of physician order entry are to capture a non-ambiguous order at the source, to permit integration of decision support into order generation, and to act on orders in a more timely fashion". We believed that in order to realize the full benefits of the electronic medical record, and support our organizational goals, we would need direct clinician-system interaction, despite the known inherent risks of this approach. We tried to anticipate and manage the challenges via early and ongoing clinician involvement in planning and implementation. Site planning and preparation, training, go-live and ongoing site support, and continuously soliciting and responding to user input were also crucial success factors.

Recent recommendations pertaining to the development and implementation of Computerized Patient Records included several items among which were: avoid requiring physicians to operate workstations until a computer stored record is accessible, minimize the amount of structured data professionals are required to enter, and demand proof of value for each additional element.⁸ We carefully adhered to these principles.

Internal and external environments were undergoing rapid change during the study period, and clinicians were significantly stressed. Regional initiatives, including those designed to improve member's access to services, placed increased demands on clinicians. The CIS project required them to input data not only for the direct benefit of their patients and their practices, but for more indirect organizational reporting and management requirements. Clinicians didn't always appreciate the importance of this work. Furthermore, despite an excellent product and considerable effort to smooth the transition to a new work flow, our data show that the early months of use caused added time pressures and changes in time expenditure by task for clinicians. Given that the study spanned and necessarily evaluated a period of considerable change including EpicCare, the very strong

endorsement seen by 4-6 months is perhaps more remarkable than the reservations expressed at 2 months.

SUMMARY

Implementation of a new clinical information system posed challenges, as expected. The implementation occurred simultaneously with other major regional initiatives involving improved clinician productivity, member access and satisfaction, and data capture. Training and learning required significant time investment on the part of clinicians. Early adoption was met with some dissatisfaction despite generally positive pre-implementation attitudes. Satisfaction with the system improved markedly by 4-6 months.

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